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Aseptic revision total knee arthroplasty: 2-year pain, function, satisfaction and expectation setting

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Abstract

Background: With rising numbers of primary total knee arthroplasties, more revision total knee arthroplasties (rTKA) are being performed. Reported patient satisfaction and functional outcomes after those procedures show great variation. We reviewed satisfaction and clinical outcomes 2 years after rTKA and discuss realistic patient expectations.

Methods: We investigated a consecutive series of prospectively collated single-stage rTKAs receiving a condylar constrained, posterior stabilised or hinged revision system (Legion™, Smith and Nephew). All surgeries were performed by two experienced arthroplasty surgeons between 2009 and 2018. Patient reported outcomes including pain, Oxford Knee Score, short form 12 and walking aid dependence were assessed preoperatively, at 3, 12 and 24 months and derived from our prospectively collected database. Satisfaction and revision rates were also recorded.

Results: The series included 80 single stage rTKA with a mean age of 69 years. At 2 years pain, knee function and mental health status significantly improved ($p < 0.001$), however physical health status ($p = 0.052$) and dependence upon weight-bearing walking aids ($p = 0.16$) did not. Sixteen percent (16%) of patients returned to theatre. Overall 64% of patients were satisfied or very satisfied with the result of revision surgery.

Conclusions: Patients undergoing rTKA can be counselled to expect improvements in pain and function in the first 2 years. Quantifying outcomes in terms of their absolute values may help to set realistic expectations, which include only fair function of their knee and residual pain of around 3/10 and a 16% prevalence of return to theatre within 2 years.

Keywords: Revision total knee replacement, revision total knee arthroplasty, single stage revision, clinical outcomes, complications

1. Introduction

The rate of revision total knee arthroplasties (rTKA) is on the rise due to a higher number of primary TKAs (pTKA) being implanted [1, 2]. Furthermore, this procedure is increasingly being offered to younger more active patients [3]. A six-fold increase in rTKA is predicted by 2030 [4]. Patients' expectations are an important factor in understanding health treatments and outcomes [5, 6] yet, the relationship is poorly understood [7, 8]. One study found the expectation is high in regards global benefit of rTKR surgery, but lower in relation to easing pain and improving function [18]. Little else has been researched.

Expectations also arise through personal experience, and by what is read, heard or, or observed in others. [9] Expectations towards a surgical procedure are partly based on the outcomes a surgeon has observed or read about, then conveyed to a patient. Predicting outcome is a challenge however, given the wide variance in rTKA outcome. Patient satisfaction rates for example, range from 42% to 86% [11, 20-23]

In pTKA, it has been shown that surgeons expect better results than patients [19]. Thus, demonstrating the differing perspectives and development of expectation that is likely to arise from a multitude of sources. The advancement of internet and social networking has rapidly expanded options from which patients can set their expectation, and in this setting, a wide spectrum of generalised outcomes is advertised.

At one end, studies suggest that patients receiving a rTKA have inferior postoperative knee function compared to those receiving a pTKA. [10-12] and greater risk of complications [17].

At the other end, some websites set a 90% expectation of good to excellent results [13]. Others report long-term recovery holds the same expectation as pTKA [14-16].

A paucity in quality research in relation rTKR outcomes, patients' expectation and their variabilities. Thus our primary aim was to report knee pain, function, and mobility afforded by rTKA at 2 years. The secondary goal was to interpret these findings in relation to setting realistic expectation for our patients.

2. Materials and Methods

This single center study investigated a consecutive series of prospectively collated single-stage rTKAs. The implants were either a constrained posterior stabilised (PS), standard PS or hinged revision knee system (Legion™, Smith and Nephew). We excluded isolated patellofemoral revisions, 2-stage revisions and polyethylene exchange cases.

All surgeries were performed by two experienced fellowship trained arthroplasty surgeons between 2009 and 2018. Indications for revision are depicted in Table 1. In rTKA cases with difficult access, a tibial tubercle osteotomy was performed to enhance exposure [29]. All components were cemented. Patients were allowed to weight-bear as tolerated the day following surgery.

Outcomes we considered important to patient goals of surgery were selected. Knee pain was reported using a numerical pain rating scale (NRS) from 0-10, with 10 being the worst pain. Knee function was assessed with the Oxford Knee Score (OKS) [30], scored from 0-48. Higher values represent better function. Mobility level was categorised according to reliance on walking aids (crutch, frame, wheelchair or stick) or not (independent of aids). We included this outcome as it holds relevance for patients in terms of their gait fluency, speed, independence and accessibility to the community.

Two researchers screened the medical notes for return to theatre episodes. These were categorised according to the nature of the event to major revision (prosthetic components revised), minor revision (removal of screws), and other (no exchange of metalwork). Patient satisfaction was evaluated using a 5-Point Likert Scale. For analysis the answers were dichotomised into 'very satisfied/satisfied' as positive and 'not sure/dissatisfied/very dissatisfied' as negative result.

Data was derived from our prospective database and the preoperative, 3, 12 and 24 month outcomes. Surgical efficacy was measured by comparing the preoperative to the 2-year postoperative outcomes. A sample size of 80 was considered sufficient to typically represent this population. The significance level was set at $p < 0.05$. Paired samples t-tests, adjusted Pearson's Chi-squared test, and descriptive statistics (frequencies and percentages) were used to present categorical data. Data analysis was performed with IBM SPSS Statistics for Windows, v25 (IBM Corp., Armonk, N.Y., USA).

3. Results

80 consecutive rTKAs were performed in 74 patients. Three patients underwent a contralateral rTKR within the study time period. The cohort demographics and reason for revision are contrasted in Table 1.

The 2-year analysis was undertaken on 72 rTKAs, corresponding to a follow-up rate of 90%. 4 patients died in the course of the study unrelated to the surgery, 3 were re-revised and 1 was lost to follow-up (Figure 1).

Patient outcomes are summarised in Table 2. Central tendency, spread and frequencies and significance level are

detailed.

At 2 years, average pain levels halved ($p < .001$). The median residual knee pain score was 3/10 (range 0-9). Mean OKS significantly improved by 12 points ($p < .001$). This degree of improvement exceeds the minimally important clinical difference of 9 points [31]. Fig 2 and 3 plot the recovery of pain and knee function time course from preoperative, 3 months, 1 year and to 2 years.

The proportion of rTKA patients dependent on walking aids decreased non-significantly from 44% to 33% ($p = 0.16$) Fig 4. On average, 4 of 5 patients were satisfied 3-months following rTKA. Rates then dropped at 1 and 2 years, at which time 64% were satisfied with their surgical result. Fig 5.

There were 3 major revisions (2 periprosthetic fractures and 1 loose tibial component) and 5 minor revisions (3 removal/refixation of osteotomy screws and 2 exchange of liners). Another 5 patients returned to theatre (2 manipulation under anaesthetic and 3 for wash out/debridement). The 2-year return to theatre rate was 16% and the overall re-revision rate 10%.

4. Discussion

This observational study gives insight to knee pain, function, and mobility after rTKA at 2 years. We confirmed rTKA to provide significant knee pain resolution and improvement in function, including a reduction in the likelihood to be reliant on walking aids. Outcome expectancies are estimates of behaviours (such as proceeding to surgery) and their consequences (being a weighing of benefit and risk). The information provided to patients influences their behaviour depending on the perceived consequence, and therefore portraying an accurate picture is an important responsibility for clinicians. We suggest expectations of rTKA should be tempered in that pain may not be absolved, and only 64% of patients are satisfied with their result after 2 years.

Our findings reflect a typical rTKA population, as they derive from a wide variety of diagnoses (with the exclusion of infection), surgical complexity and implant constraint. A meta-analysis from 2002 averaged a slightly younger 67 years of age and lower propensity toward female gender 61% (11). Our cohort had superior knee function at baseline (20 OKS points) in contrast to cohorts in the literature with OKSs of 16.2 [11] and 17.5 [22].

4.1. Pain

There is little doubt that rTKA affords a degree of pain relief, however the extent to which it does so varies. Hamilton *et al.* [26] examined aseptic rTKAs and observed a change from NRS 7.7 to 1.3 at 2 years. Our cohort experienced a smaller effect size, owing to both a lower preoperative level of 6/10, and a higher 2 year pain average of 3/10. Few other studies have utilised a valid pain score, with many extracting conclusions from composite scores.

4.2. Knee function

The degree of knee function improvement afforded by rTKAs is not well understood. Turnbull *et al.* found 90% of patients maintained their activity levels, but less than half increased them [8]. Meta-analyses [11, 32] support rTKA to be an effective procedure that improves patients' knee function. When using the OKS, a clinically meaningful improvement in knee function is considered a change of 9 points [31]. Whilst our cohort averaged a significant 12-point improvement at 2 years, the mean score of 32 falls into a category considered fair, as opposed to good or excellent [33]. Other researchers

have found improvements bordering clinical relevance: 10 OKS points at mean 7 month follow up ^[11] and 9 points ^[22] at 2 years.

4.3. Walking Aids

Dependence on weight-bearing walking aids is rarely reported as an indicator of rTKA success. Lewallen *et al.* ^[34] found a 2-5 year dependence rate of 6.2-8.2% in pTKA and also studied rTKAs together with Singh *et al.* ^[27] but did not include the overall prevalence. An expectation to achieve independence from any assistive aids, we can conclude with low confidence as rates post-operatively were only marginally improved, with 25% of dependent patients becoming independent after surgery.

4.4. Complications

The overall effectiveness of rTKA must be considered in light of its complication rate. In this study, the mean complication rate was relatively high with 16% of patients returning to theatre and a revision rate of 10% within the initial 2 years. Our revision rate matches that of Kim *et al.* ^[35] in their recent study of 280 rTKAs with mobile bearing implants. It must be noted their cohort included 52 septic cases and their follow up was longer with an averaged 59 months. A cumulative 12.9% revision rate over an average 53 months was published in Saleh's meta-analysis, and a similar rate in the 2011 registry data review by Labek ^[36]. Higher revisions rates for rTKA are expected given the higher degree of technical challenge and risks associated with the procedure.

4.5. Satisfaction

A meta-analysis from 2002 reports great variation in rTKA satisfaction rates between 23% and 89% ^[8]. More recent studies (including only aseptic aetiologies) report a range of 47% and 86% ^[11, 21, 22, 37]. The satisfaction level at 2 years that we report sits midway at 64%.

Of interest, we observed a drop off in satisfaction from 3 months (80%) through to the end of second year (64%). This longitudinal trajectory was not mirrored in terms of knee pain or knee scores. Walking aid dependence however, also worsened. While 31% were dependent at 1 year, this figure slightly increased to 33% at 2 years. Trend of worsening pain and function has previously been correlated to an increased number of comorbidities ^[38]. This was not something we measured. On closer examination of the 10 patients satisfied at 1 year but not at 2 years, we did note persistent and increased pain level in every case. All but 1 patient also reported decreased knee function. It seems in this complex

rTKA group, identification of the cause for the decline in outcomes after the initial year, requires more robust and sensitive measures.

4.6. Expectation setting

The secondary goal of our study was to translate the study findings to support our patients to form realistic expectations. In previous studies comparing rTKA with pTKA, Greidanus *et al.* report 73% and 86% satisfaction ^[10] and Baker *et al.* report 66% and 83% ^[11], for the respective surgery types. In light of these literature reports and the 64% satisfaction rate we observed, we advocate patients should be counselled not to base their expectations upon their previous experience of pTKA. Whilst most rTKAs provide significant improvement in pain and function, patients should be counselled that improvements tend to be larger following primary than revision surgeries, and the absolute outcome is worse in comparison ^[10-12]. This is partly due to the fact that their physical ability may not start at an equal level, and partly due to the more complex nature of the surgery.

A transparent discussion informing prospective patients of the lesser degree of certainty around the efficacy of surgery, and to realistically expect improvement to a "fair" rating of knee performance is required. Furthermore, expectation can be set to have improved but incomplete resolution of pain, and a 1 in 10 possibility of subsequent revision by 2 years following surgery. Whilst this paints a reasonably grim picture, well-informed patients actively-involved in shared decision-making also sees a sharing of responsibility for health outcomes.

4.7. Limitations and Strengths

Our study has a number of limitations. First, even though data was collected prospectively, it was evaluated in a retrospective manner. Second, our study sample is only moderate in size and our results may be prone to drop-out bias. Third, patients' comorbidities were not scrutinised. The last potential limitation is the rather short follow-up of two years. One strength of the study is that all surgeries were performed in a standardised manner by two experienced revision arthroplasty surgeons in a single centre. Also, only major revisions (change of implants) were included while minor revisions (polyethylene exchange, patellofemoral revision) were excluded. This minimises the bias towards better postoperative results. Another strength was to include patient-relevant outcomes such as walking aid-dependence, of which there is little data reported.

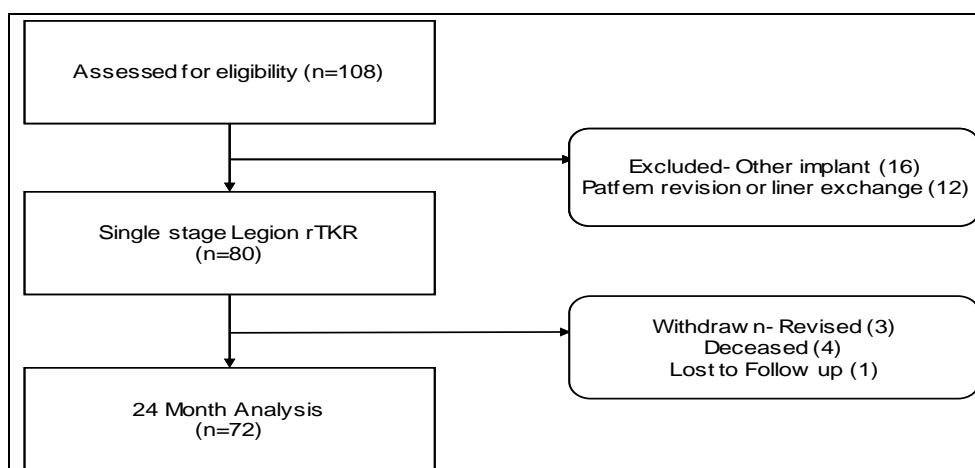


Fig 1: Patient Flow

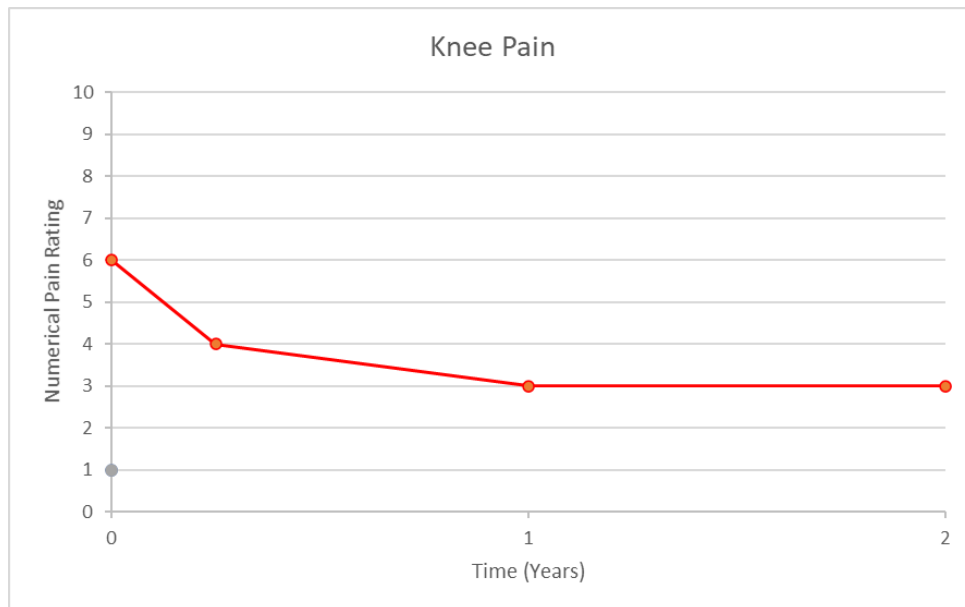


Fig 2: Mean numerical pain rating of knee pain following rTKA

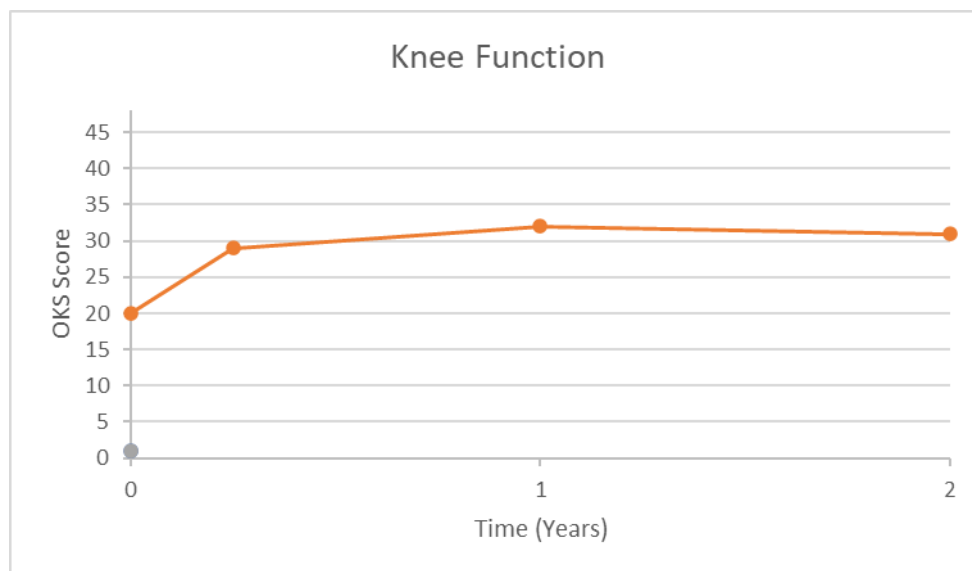


Fig 3: Mean Oxford Knee Score following rTKA

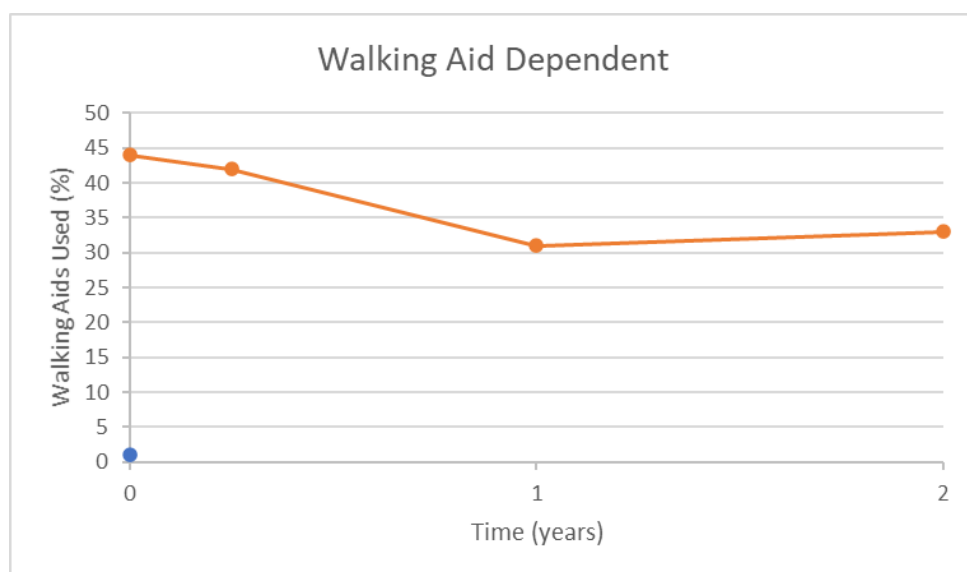


Fig 4: Percentage of patients dependent on weight bearing aids after rTKA

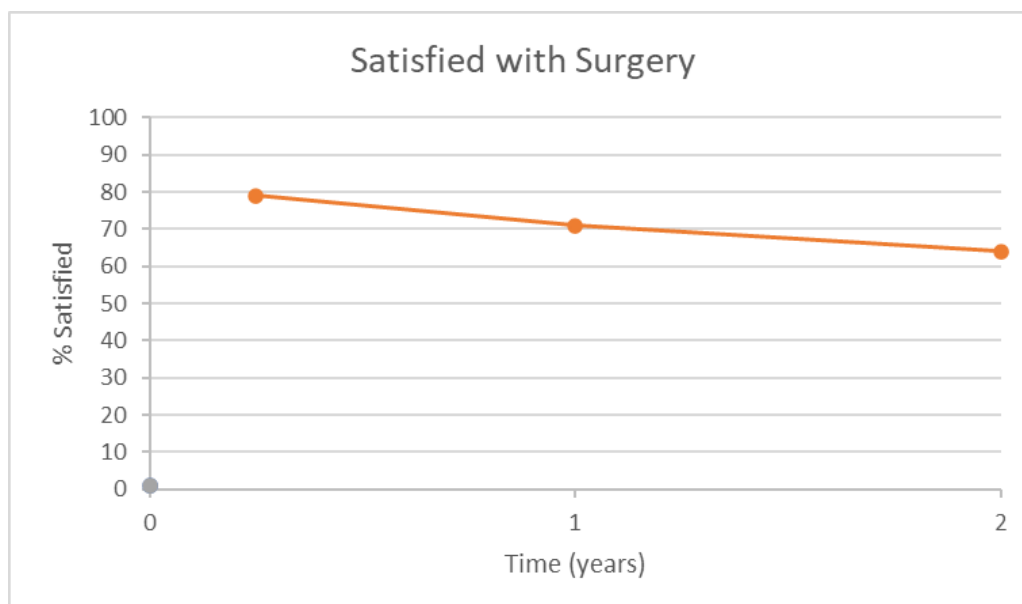


Fig 5: Percentage of patients Satisfied or very Satisfied with their rTKA outcome

Table 1: Preoperative Patient demographics. Mean (Standard Deviation) and percentage (count analysed) unless stated otherwise

	rTKA n=80
Age (years)	69 (9)
Gender	
Female	63 % (47)
Male	37% (27)
Body Mass Index (kg/m ²)	31 (6)
Aetiology	
Loose Component	41% (33)
Component Malposition	14% (11)
Instability	11% (9)
Worn Component	11% (9)
Arthrofibrosis	10% (8)
Fracture	6.5% (5)
Other	6.5% (5)
Implant design	
Constrained PS	81 % (65)
Standard PS	14 % (11)
Hinged	5 % (4)

Table 2: Clinical outcomes following single stage rTKA. Mean (Standard Deviation) and percentage (count) unless stated otherwise

	Preoperative n=80	2 Year n=72	P value
Pain (0-10)	6 (2)	3 (2)	<0.001
Oxford Knee Score (0-48)	20 (9)	32 (10)	<0.001
Walking Aids used (%)	44%	33%	0.16
Satisfied (%)		64%	
Return to Theatre		13 (16%)	
Revision		8 (10%)	
- Major		3 (4%)	
- Minor		5 (6%)	
Other		5 (6%)	

5. Conclusion

Some patients undergoing aseptic rTKA experience significant improvement in pain and function, however on average, expectation of a 'fair' level of function should be set. There is a 16% chance of return to theatre in 2 years. Prospective rTKA patients should be counselled accordingly, particularly if their expectations are to be pain-free or to return to moderately physically demanding activities, as this is not the typical scenario.

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